

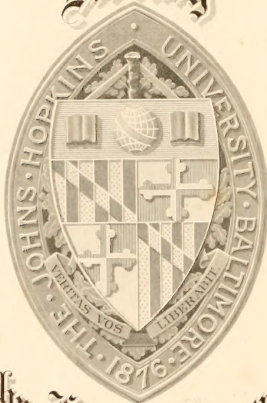
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Johns Hopkins University



Some Double Chlorides of Ferric and
of Ferrous Iron with Some
Aromatic Bases.

Dissertation.

Submitted to the Board of University Studies
of the Johns Hopkins University
for the Degree of
Doctor of Philosophy

by

Raphael Monroe McKenzie

1896.

Concise.

Summary.

Double halides of iron previously described.

Properties of the halides.

Testing of methods of analysis; iron, chlorine, water.
Atomic weights used in this work.

Oxidation of the organic base by ferric
chloride.

Preparation of the double halides.

Variation of the salts for analysis and the
results of the analyses.

Summary of the results of the analyses.

Conclusion.

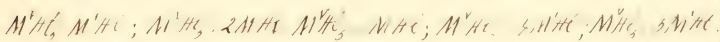
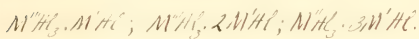
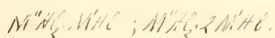
Appendix.

Acknowledgments.

This investigation was undertaken at the suggestion of Professor Romsen and was carried out under his direction. I wish to acknowledge here my indebtedness to him for suggestions in the course of the work and for encouragement in times of trouble. I wish also to thank Professor Brown and Dr. Ames for instruction in the methods of the work.

Introduction.

The subject of double halides was discussed in an article by Professor Remsen in 1888, in which he introduced the double halides now received together with the views previously held in regard to them. He showed that almost all the double halides mentioned in the literature - in all over four hundred - could be arranged in a few simple series which might be represented by the following types:



In these types M'' represents any polyvalent metal and M' any alkali metal.

From this study the generalization was drawn that, "when a halide of any element combines with a halide of an alkali metal to form a double salt, it is a moderate evidence that the element is a metal."

are added to one molecule of the other halide, is never greater and is generally less than the number of halogen atoms combined in the latter? If the halogen atoms are considered as bivalent, then, "the halogen atoms together can play the same part that the so-called linking oxygen atom plays in the oxygen salts"; thus the double halides were rescued from the name salts of molecular compounds and given a place among the atomic compounds. A case in point is potassium platinate, $K_2 Pt Cl_6$, which under the older name was considered as molecular compounds of two molecules of potassium chloride and one molecule of platrichloride. Thus, $2KCl. Pt Cl_4$, are now considered as salts of definite chloroplatinic, as the hydrochloroplatinic acid, $H_2 Pt Cl_6$.

Just as acidic oxides combine with basic oxides to form salts, so acidic halides combine with basic halides to form double halides. This sim-

stability between the oxygen salts and the double
halides is seen from the following formulae:-



A thorough investigation of these compounds
given in the literature, which did not fall
under this law, was undertaken by students
working under Professor Renshaw. The work was
also carried further in order to obtain all the double
halides of the metals under investigation, that
could possibly be formed under any conditions.
In the course of this study some double halides
were discovered that did not fall under the law.
Therefore an extension of the law was made to
include these and some other salts, as $\text{CuCl}_2 \cdot \text{HCl}$
and $\text{CdCl}_2 \cdot \text{HCl}$, which had long been known.
Some other double halides of cadmium and cerium
have since been brought out by Hale and
Renshaw and by Hale and Renshaw.

for example, the same is true of the halogens. Belonging to the extreme of the group, these halogen atoms can act together to form a triatomic group, --Cl--Cl--Cl-- . Then the salt KCl_3 has potassium chloride, white, $\text{Ca Cl}_2 \cdot 2\text{KCl}$ are represented thus Ca--Cl--Cl--K .

It appears from the work of Saunders¹ that double halides do not form from halides of metals belonging to the same natural group.

The work on the double halides has been extended into the field of organic chemistry by the use of the substituted ammonias of the ammoniac series in place of ammonia. Such double halides of tin, mercury, antimony, bismuth and arsenium have been studied in this laboratory. It is in this part of the general work on double halides that this investigation pertains.

¹ Amer. Chem. Soc. 74, 157.

A calcium salt Lehmann, *Zeit. f. Elektrochem.*
 (or analogous) 10, 336.

3 At. Fe. 2 At. H₂O 1 At. H₂O
 2 At. Fe. 2 At. H₂O

In the Fall of 1894 there were published the results of a systematic study by Gmelin of the double halides of ferric iron with sulphuric, calcium, potassium and ammonium in which he found $3\text{FeCl}_2 \cdot 2\text{H}_2\text{O}$ and $2\text{FeCl}_2 \cdot \text{H}_2\text{O}$. He did not mention the work of Lehmann, which was the first more previously published, and he gives the salt $2\text{At. FeCl}_2 \cdot \text{H}_2\text{O}$, obtained by Lehmann, as a new compound. The salt $3\text{At. FeCl}_2 \cdot 2\text{H}_2\text{O}$ according to Lehmann is not new in the sense that it is a salt of iron must have had the salt $2\text{At. FeCl}_2 \cdot \text{H}_2\text{O}$.

The salts obtained by Lehmann are -

3	1	2	1	1	1
3 At. FeCl ₂ · 2 H ₂ O	2 At. FeCl ₂ · H ₂ O	1 At. FeCl ₂ · ½ H ₂ O			

3:1

2:1

1:1

2 C Br. FeCl₃ H₂O2 Rb Cl. FeCl₃ H₂O2 K Br. FeCl₃ H₂O2 A Cl. FeCl₃ H₂O +2 NH₄ Cl. FeCl₃ H₂O +NH₄ Br. FeCl₃ 2 H₂O

"versing the iron by Frey's" (?)

Preparation of ferric chloride.

The ferric chloride was prepared by dissolving ferro-nickel in an excess of fuming hydrochloric acid and oxidizing the solution of ferrous chloride formed by passing into it a stream of chlorine gas until no reaction for ferrous iron could be detected with potassium ferricyanide. The solution was then repeatedly concentrated by evaporation to drive off all chlorine. But small amounts of ferrous iron were added to prevent the separation of ferric chloride.

ide at ordinary temperatures; and the amount of ferric chloride in one cubic centimeter of the solution was determined. Another solution of ferric chloride was prepared by diluting 100 c.c. of the concentrated solution up to 250 c.c.

In the earlier part of the work saturated solutions of ferrous chloride were prepared from iron wire and the content in ferrous chloride at a definite temperature was determined; but they could not be kept free from ferric chloride. The same should attend the use of crystallized ferrous chloride.

In the later part of the work the ferrous chloride was obtained by dissolving the calculated amount of iron wire in an excess of hydrochloric acid in the vessel in which the same salt was to be made.

Ammonium hydrochloride was prepared by heating the last solution of ferric chloride with

with six parts by volume of pure concentrated hydrochloric acid, ~~in a glass bottle~~. The acid in hydrochloride which separated on cooling was filtered off by aid of the pump, and dried on a porous plate, or by pressing between filter paper in a press. The triidinic hydrochlorides were prepared in the same manner as the anisidine hydrochloride.

Method of Analysis.

Iron.— Since the conditions were complicated by the presence of chlorine with the triidinic salts for the analysis of iron could not be used. Much time and work were, therefore, required to obtain a satisfactory method of analysis. A method was sought which would permit the determination of both the iron and the chlorine in the same sample, but without success.

For the testing of methode, weighed amounts of pure ferrous ammonium sulphate and of anisidine

hydrochloride were mixed and analyzed. Such mixtures were fused with sodium carbonate and a little potassium ^{nitrate} carbonate to remove organic matter. The ~~the~~ ^{the} xii, and xiii, gave no result, as they were in formic acid, but this method gave results that were too high ± 0.5 to 1.5% . This was due, no doubt, to the presence of alkali salts retained by the formic acid.

Other weighed mixtures were fused with potassium pyrosulphate; the pyrosulphate formed was reduced with zinc and sulphuric acid, and was titrated with a solution of potassium permanganate. This method was discarded because the pyrosulphate was not completely reduced, and the unburned carbon was left in the melted mass and the fused mass frothed over the edge of the crucible. The carbon was consumed in the reduction with zinc and the fact that the presence of any organic matter showed

anted the result.

To obtain satisfactory results - by precipitation of the iron from the soluble salts with potassium-hydroxide, a second precipitation with ammonium-sulphate to free the ferric oxide from the alkali. This method although exact was too long, and so many analyses were to be made.

Attempts were also made to destroy the organic matter by oxidation with fuming nitric acid, and with potassium chlorate and glycolonic acid; but these were abandoned as the iron could not exist.

The method finally adopted was the following: The copper salt was dropped into a porcelain dish containing an excess of a warm solution of pure potassium-hydroxide. The dish was then heated on a sand bath until the solution no longer gave any odor of ammonia or of hydrazine - water was added from time to time as required. The

solution was then neutralized with hydrochloric acid and an excess of the acid was added. In many cases the ferric hydroxide has been hastily removed by action on the residue, a small amount of hydrogen peroxide was added and the solution was, then, evaporated just to dryness. A little more acid was now added and it was again evaporated to dryness. In the case of ferric salts the oxidation with hydrogen peroxide was always required. The ferric chloride was then filtered into a flask a little larger than the bottle, to avoid any loss of the liquid in the filter. The filtrate was then treated with a solution of potassium hydroxide until a slight permanent precipitation of ferric hydroxide is obtained. 2 cc. of dilute hydrochloric acid was added and 1 gram of potassium cyanide is introduced. The flask is then closed and heated at about 60° for twenty minutes. After cooling, the same solution was

titrated in the bottle by use of starch and a solution of sodium thiosulfate, 1 cc. of which corresponds to 1 mg. of iron. The results were quite satisfactory.

The iron was determined in a paper by the use of the method of the iodine titration, as described in the literature. The use of the iodine dish and the evaporation of the ferric chloride to dryness was found necessary, to ensure the complete removal of the hydrogen peroxide. The hydrogen peroxide is more stable than was formerly supposed. It was found that hydrogen peroxide passed off with the steam and condensed on the sides of a flask running back into the water and causing error in the analysis. The water which condensed on a watch-glass held in the steam above the flask, also gave a strong reaction for hydrogen peroxide when tested with iodine and starch.

chromine - as the price paid for the chromate
tion the chlorine was determined gravimetrically;
but as the chromate is not entirely soluble, and
reacts to form precipitates and colored solutions, the
precipitation of the chlorine was not entirely satis-
factory.

The Lohmann method was tried with a solution of
a ferric double halide acidified with nitric acid; but
it could not be used thus, as the end reaction
with the sulphocyanate was masked by the color
of the iron. After the iron was precipi-
tated, but the presence of the nitrogen necessitated
the use of soda-lime. As the soda-lime contained
a large amount of the halide, a mixture of sodium
carbonate and lime as suggested by H. Brinson
was tried; but, first then, a more satisfactory
method was obtained and these trials were discon-
tinued.

The method finally employed was the following:-

1. Sample

A weighed sample of the salt was dropped into an Erlenmeyer flask containing a solution of pure potassium hydroxide, which was in excess of the amount required to decompose the salt. The alkaline solution was then boiled until the odor of aniline was given off. Then the solution formed and coloring the ferric hydroxide in an excess of nitric acid remained colorless. If all the organic base had not been driven off with the water vapor, a colored solution was formed. To the acid solution five cubic centimeters of a saturated solution of ferric ammonium alum was added; and the cold solution was titrated by Lohmann's method in the flask.

In the case of the ferrous salt, a cold solution of the salt in very dilute nitric acid could be titrated directly without boiling off the base. But in most cases the method given above was used.

Heat & Sublimation. At 110° C. the
sublimation of the salt was
unsuccessful. Samples of the salt
placed in the sulphuric acid desiccator did not
come to constant weight even after standing more
than a month. It was found that the inside
of the desiccator and the watch-glass containing the
salt became coated with a sublimate.

Samples of the salt were heated from 90°-110°
in a glass tube, the closed end of which was placed
in an air-bath while the other end extended out into
the air. Here it was found that a sublimate was
deposited on the inner wall of the tube. The sub-
limate did not melt and was not soluble in
water.

It was then thought that the water might be
determined by absorption in a drying-tube. To try
this a sample of the salt was heated in a por-
celain boat within a glass tube which extended

through an air-bath. Air was drawn slowly through the tube while the air-bath was heated to 100°C ; when it was found that the aniline hydrochloride and also the toluidine hydrochloride sublimed and was deposited on the cooler parts of the tube, where ice water was carried farther to still colder parts of the tube. To test whether aniline alone was carried on by the air current, a U-tube ^{containing} a solution of silver nitrate was attached to the front end of the tube, and air was drawn through it. After a few minutes the solution became cloudy and a precipitate formed showing that compounds containing chlorine were carried over. This prevented further attempts being made.

The same experiment was made with the following results: The solution of silver nitrate in the U-tube became cloudy and a precipitate formed. The U-tube was washed with water.

it in cold water. The salt was heated in the porcelain boat as before, and air was drawn through the system. If the salt contained water, it was deposited on the walls of the U-tube as a dew or in drops. The amount deposited giving some idea of the proportion of water in the salt, and confirming the analytical results.

Some of the salts were analyzed before this method was used, and in these cases nothing has been said as to the water, though the analytical results require the assumption that water was contained in them.

The ~~relative~~^{atomic} weights used in the calculations of the results for the salts were as follows: H, 1; O, 16; N, 14; Fe, 55.4; Ti, 56; C, 12.

It was found that the differences in the known values for the salts were not more than a tenth of one percent when calculated with the more exact ~~molecular~~^{atomic} weights.

Oxidation by Ferric Chloride.

much difficulty was experienced in the early part of the work owing to the tendency of the ferric chloride to oxidize the organic base. Thus, when a solution of aniline hydrochloride and ferric chloride was mixed, the action which took place was the decomposition of the aniline hydrochloride and the reduction of the ferric chloride to ferrous chloride. In many cases, a fine, flocculent precipitate appeared in such quantities as to fill the solution. In other cases it appeared in smaller amounts, but interfered with observation.

Slightly acid solutions were made in the ratio of one molecule of ferric chloride to two molecules of aniline hydrochloride, or one molecule of ferric chloride to four molecules of aniline hydrochloride, and of one molecule of ferric chloride to five molecules of aniline hydrochloride. The first solution was colored a light green on mixing, and appeared on

heating, when it became filled with the blue precipitate.
The second solution with a smaller proportion of ferric
chloride was a lighter green than the first, but, on
heating and standing, it darkened, and the precipi-
tate formed. The third solution was a yellowish
green color on mixing, but, on heating, the upper
layer exposed to the air became green, then the
precipitate began to form, and in a short time
the whole solution.

It was found later that the oxidizing action
of the ferric chloride was greatest in hydrochloric acid
solution, and that it was decreased by the addition
of any hyponitric acid. I also found that
dissolving the residue of hydrous ferric chloride in a mixture
of three parts of concentrated hydrosulfuric acid to
one part of water, could be boiled with little or
no formation of the precipitate.

In the work on antimony trichloride it
was found that the oxidizing action of the

peric chloride could not be accounted for by increasing the amount of acid in the solution. Even solutions which had been saturated with hydrogen peroxide acid gas decompose on heating.

Ladenberg¹ describes the product formed by the action of peric chloride on orthotoluidine hydrochloride as a blue dye - thionine blue - which substance is a flocculent precipitate. It is colored green by hydrochloric acid. The paratoluidine hydrochloride does not form such a compound. - These results are confirmed in this work.

This work is of course in accordance with some qualitative experiments as to the relative ease and rate of oxidation of aniline hydrochloride, of o-toluidine hydrochloride, of m-toluidine hydrochloride and of p-toluidine hydrochloride by peric chloride. The results are here given:

Feb. 13, 30 Pm. 0.398 gram of aniline hydrochloride was dissolved in 8 c.c. of hydrochloric acid (sp. gr. 1.18).

¹ Berichte 1875, 1127.

To it was added .5 gram of basic cobaltous chloride. When the solution was set aside at the ordinary temperature.

Feb. 14, 11. A.M. - The solution had changed color only slightly to a slight yellowish-brown.

Feb. 15, 11.30 A.M. - The solution had become a dark green in color and a slight amount of a greenish precipitate had separated.

Feb. 17, 11 A.M. The solution had become still darker in color and contained the green precipitate in quite large amount. 3 P.M. - The solution had separated into two layers; one, about two-thirds of the whole, was dark green and was filled with the precipitate; the other layer was a clear greenish-yellow liquid.

Feb. 18, 3 P.M. - 0.442 gram of 5-toluidine hydrochloride was dissolved in 8 cc. of hydrochloric acid of sp. gr. about 1.12; 0.5 gram of basic cobaltous chloride was added and the solution was set aside at the ordinary temperature.

Feb. 17, 11 A.M. The solution had become a dark greenish black in color and opaque. This was due

to a green precipitate which had formed; in ten
years the clear liquid had become, with the same
color as a solution of ferric chloride of the same strength.
Feb. 15, 10.30 A.M. - The color of the solution had not
changed very much, but more of the precipitate had
formed. The amount being about twice that in
the solution the day before.

Feb. 17, 3 P.M. - The solution had become
a brownish-yellow color, and the precipitate was still
increasing. The amount of precipitate was now
nearly the whole solution.

Feb. 13, 3 P.M. - 0.442 gram of anhydrous hydro-
chloric acid was dissolved in 8 c.c. of hydrochloric acid
sp. gr. - about - 1.12. 0.5 gram of ferric chloride was added
and the solution was set aside at the ordinary
temperature.

Feb. 14, 11 A.M. - The solution was a dark greenish-
black in color, very much like the solution of
anhydrous hydrochloric acid. In this respect the color

is more like that of the solution of ascorbic hydrochloride - a greenish-grey. There is only a slight precipitate in a very fine state, not like that from the *o*-toluidine hydrochloride.

Feb. 15, 10.30 A.M. - more of the precipitate had separated, but the amount was still not very large.

Feb. 17, 3 P.M. - The solution in this layer had about the same color as the solution of the *o*-toluidine hydrochloride. The amount of precipitate was not so great as in that case.

Feb. 13, 3 P.M. - 0.442 gram of *o*-toluidine hydrochloride was dissolved in 8 c.c. of hydrochloric acid (sp. grav. about 1.12). - 0.5 gram of ferric chloride was added and the solution was set aside at the ordinary temperature.

Feb. 14, 11 A.M. - The solution was clear, but the color had changed to a yellowish-brown as seen in thick layers. In thin layers it was a brownish yellow color.

Feb. 15, 10.30 a.m. - The solution was cold, but the color had become somewhat richer.

Feb. 17, 3 P.M. - no change could be detected in the solution since the last observation. After some time had elapsed, it was found that there was no oxidation of the p-toluidine hydrochloride.

The results of the experiment show that p-toluidine hydrochloride is the most readily acted on by the peric acid; the m-toluidine hydrochloride comes next, the aniline hydrochloride is the least easily attacked, whilst the p-toluidine hydrochloride is not acted on, as will be seen in the following table.

Chemical Analysis

$\text{FeCl}_3 \cdot 2 \text{C}_6\text{H}_5\text{NH}_2\text{Cl}$	Iron Chloride
$\text{FeCl}_3 \cdot 2 \text{C}_6\text{H}_5\text{NH}_2\text{Cl} \cdot \text{H}_2\text{O}$	Hydrated Iron Chloride
$\text{FeCl}_3 \cdot 6 \text{C}_6\text{H}_5\text{NH}_2\text{Cl}$	Hexamethine Chloride
$\text{FeCl}_3 \cdot 4 \text{C}_6\text{H}_5\text{NH}_2\text{Cl} \cdot 2 \text{H}_2\text{O}$	Hydrated Hexamethine Chloride
$\text{FeCl}_3 \cdot 4 \text{C}_6\text{H}_5\text{NH}_2\text{Cl} \cdot \text{H}_2\text{O}$	Hexamethine Chloride
$\text{FeCl}_3 \cdot 2 \text{C}_6\text{H}_5\text{NH}_2\text{Cl}$	Dimethine Chloride
$\text{FeCl}_3 \cdot 3 \text{C}_6\text{H}_5\text{NH}_2\text{Cl}$	Trimethine Chloride
$\text{FeCl}_3 \cdot 3 \text{C}_6\text{H}_5\text{NH}_2\text{Cl}$	Triphenyl Chloride
$\text{FeCl}_3 \cdot 2 \text{C}_6\text{H}_5\text{NH}_2\text{Cl}$	Iron Chloride
$\text{FeCl}_3 \cdot 3 \text{C}_6\text{H}_5\text{NH}_2\text{Cl} \cdot \text{H}_2\text{O}$	Trimethine Chloride
$\text{FeCl}_3 \cdot 6 \text{C}_6\text{H}_5\text{NH}_2\text{Cl}$	Hexamethine Chloride
$\text{FeCl}_3 \cdot 4 \text{C}_6\text{H}_5\text{NH}_2\text{Cl} \cdot \text{H}_2\text{O}$	Hydrated Hexamethine Chloride

To purify the salt in much the same way as
and ^{fully the aid of} the same process, but the
water is removed, and the salt of the hydrochloric
acid was extracted by boiling them down in
a retort over sulphuric acid and added lot
sodium hydroxide. This method slightly in all
fact was used by Beaumont who found the con-
sistence in acid emerges that is used.

The next step was to purify the
to the same degree of purity as the salt
and to remove the water and to remove the
the method of formation and to be suitable for the
earth. There are all composed of salt and water
recrystallized only from concentrated hydrochloric acid.
Some of the salt are obtained from the in
crystallized salt are in solution or the salt in the
drying some from the solution in the

Silver nitrate, AgNO_3 , 26.4, 24.4, 22.4.

Solution of silver nitrate and nitric acid
added in the ratio of 2 barrels of the former
to one of the latter, at 3:1, or 4:1 or 8:1
give this salt. The solutions 2:1 and 3:1 are
the best for the purpose of the salt. It is
a further concentration, a cop of this salt.

Silver nitrate 2:1. A solution of
adding 2 p.c. of a solution of silver nitrate
containing 6 p.c. of silver nitrate, about 50 cc.
of nitrochloric acid, nearly pure white
incubated acid to one part of water, and re-
solving in it 2.4 p.c. of silver nitrate
chloride. After condensing for some time in
the sand-bath and cooling, no crystals appear.
The solution is evaporated to the point
at which the first crystals appear, and
then a cop of crystals is obtained by
cooling. The crystals in mass are white.

green color; the color, however, as a light green
is seen. The sample was analyzed. No
alteration in green color by the salt.

Solution in ratio 3:1. - A solution in this
ratio was made by adding a drop of the mixture
concentrated. The mixture was then stirred in
sulfuric acid for a week and a large quantity
thick needles, which after drying, appeared to be
the same green salt obtained from solution
2:1. Not enough of the salt was obtained for
analysis.

Solution in ratio 4:1. - A solution was made
by adding 24 grams of anhydrous cobaltous to
32 cc. of a solution of picric chloride, containing
12 grams of picric chloride, and mixing thirty
with hydrochloric acid. There was no addition
of the picric chloride on the anhydrous cobaltous
in this case, as the solution was made in
such that no more. The green precipitate

formed mass, turned off as you please, and
 and the water was cold, but no salt was
 added. After further concentration the mass
 showed a white crystalline mass of 1 lb.
 in weight. They had a resinous brown color.
 The dry powder was given. On adding wet
 sulphuric acid a second mass of the crystals,
 which looked black in solution, separated. On
 drying they were found to be dry, then in
 a few days. The mass was a white
 mass white.

The mass was dried in a dry mass
 from solution 2:1 and the following results.

Calculated for		Found.	
in a solution		in a solution	
$\text{Fe}_2\text{SO}_4 \cdot 2\text{H}_2\text{O}, \text{NH}_4\text{Cl}$		4:1	2:1
Water	42.04%	41.87%	41.85%
		42.01%	41.95%
Iron	13.30%	13.04%	13.57%
		13.34%	13.57%

The salt would be found in a solution
from which it is precipitated by adding a solution
of sodium carbonate. The white powder obtained
is a salt. By the addition of the solution
of sodium carbonate the salt is precipitated in
white crystals. The salt is a mixture
in water of sodium carbonate and in water. Some
solutions of the salt are found to be
up water in standing.

Hydrogen chloride solution, HCl , H_2O , HCl , H_2O .
A solution in the ratio of 4:1 was found to
contain 100 cc. of concentrated hydrochloric acid
32 cc. of a solution of hydrochloric acid, which contained
12 grams of hydrochloric acid, and also by
the addition of 20 grams of water. The
It was added in the acid solution and the
it, but it did not appear. The solution was

July 11.

A solution was prepared in the ratio 8:1, containing 12 grams of H_2SO_4 and 1.2 g. of H_2O . This was added to the sand-
stone in a flask and a current of
solution was changed; on adding a portion on a
piece of it no longer met the solution
but collected in drops. This solution was
given a very faint pink color when
in contact with it. The solution was deli-
vered sulphuric acid to increase the yield of the
compound, but a sudden change in the reaction
caused the solution to become acidic and the com-
pound to be precipitated. The solution was then
diluted with water and the solution
was allowed to stand for the solution to be
in this state for some time.

These were all the results obtained by it. It
was in a large quantity of the solution.

to contain H₂O₂, which is oxidized to the
oxygen which is then used.

The first thing I have seen to do is
take the waste and see how the water is
going to be used. It is the solution of the
the water which is going to be used. It is
a part of the chemical solution which is
used. It is the water which is used in
the process.

the chemical solution, the water, and

The preliminary work on the salt was entirely
unsuccessful owing to the oxidation of the sodium
hydroxide, as was mentioned. The salt is not
stable in the air and is not stable in the
water. It is not stable in the air and is not
stable in the water. It is not stable in the air
and is not stable in the water.

It is not stable in the air and is not
stable in the water. It is not stable in the air
and is not stable in the water.

It is obtained from some countries in which
sulfur occurs, either as a native element, or as a
mineral. By the burning of pyrites, or other
sulfuriferous rocks, it is obtained in the form of
very much crystallizing in the case, when the
crystals cross each other in the middle giving
a very beautiful structure.

The salt is very soluble in water, and is a
kind of acid; but it is decomposed at the same
time, and the acid which results is a
kind of hydrochloric acid. The acid is
previously described. The solution of the salt
in ~~the~~ hydrochloric acid is a white liquid
from a light yellow color in water solution, to
a blackish green color in concentrated solutions
which have lost some of the.

When the salt is added to a solution of
sodium hydroxide, it forms a white precipitate
which is added to a solution of the salt in

was added to 10 cc. of ammonia in a 100 cc. beaker
 and the mixture was allowed to stand for 24 hours in a
 waterbath. On adding this solution, a brown
 fine sandy precipitate was formed - yellow in color
 at first. 10 grams of the solid was obtained.

Solution in the ratio of 1:1. A solution was
 made by mixing 10 cc. of a solution of glucose
 with an equal volume of 1% hydrochloric
 acid of 50% alcohol. This mixture was
 to 5 grams of aniline hydrochloride. From this solu-
 tion 3.1 grams of a solid was obtained which was
 a fine sandy precipitate which in the water had
 a golden yellow color. The results of the analysis
 of these salts are the following:

Aniline salt		Triethylamine	
Triethylamine salt		Aniline salt	
Triethylamine salt	2:1	1:1	
Calculated	33.24%	33.44%	33.48%
Found	33.24%	33.44%	33.48%

There was no water in the precipitate.

London 21st Dec 1870
Dear Sir,

Solution in 20 cc. of solution of 20 cc.
of 5% solution. 20 cc. of 5% solution
- was added to 20 cc. of concentrated HCl solution
and 8.5 grams of anhydrous sodium chloride was dis-
solved in it. It was sufficient to dissolve all
the solid material. The solution was then
diluted to 100 cc. with water. The solution
was then used for the purpose of the
solution. 6.47 grams of the salt was added to
the solution. The solution was then used for
the purpose of the solution. They were also of a color
yellow color when in the solution and when dried
they had a brown color.

Sample 1.4. A solution con-
taining 3 grams of glacial acetic acid and 4.5 cc. of
a 10% solution of sodium acetate was mixed
with 10 cc. of water and 10 cc. of 10% solution of
sodium acetate. The solution at first was made up to 100 cc.

on cooling it became very solid with the salt.
 It was then, dried with strong sulphuric
 acid and on cooling the salt separated
 in yellow crystals. The analyses of these salts
 give the following results:

Substance	Found in salt	Found in salt
St. G. 403 A H A	sol. 1:2	sol. 1:4
Alumina 33.94%	34.64%	33.75% 33.50%
Sulphur 5.12%	5.11%	5.11% 5.11%

The salt was first obtained from a solution
 in the ratio of 1:4 as follows: - 11.6 cc. of
 a solution of ferric chloride, containing 3 gms.
 of ferric chloride, was diluted to 25 cc. with water
 and 3 parts of concentrated acid to one
 part of water were added. The mixture
 was allowed to stand for 24 hours. The
 crystals were then washed with water and dried.

[illegible]

The above values are the same as in the

Table of values

Table of values

Table of values

Table of values

Table of values

Table of values

Table of values

Table of values

Table of values

Table of values

are in. - These are in use in the mines.

The men & the mules were loading;

Feb. 11, 1893

35. 24 11
 35. 64 11
 35. 78 11

... ..

The cat gave up no more on Sunday 6. 18.

the soil is very soft and the
 the soil is very soft and the

the soil is very soft and the
 the soil is very soft and the

the following results:-

Initial.	Found.		
	I	II	III
33.74*	33.83	33.44*	33.61*
	33.68	33.44*	33.55*
33.96*	33.1*	33.1*	33.1*
		6.23*	6.70*

Hydrogen peroxide solution. H_2O_2 10%, H_2SO_4 20%
 a solution of hydrogen peroxide and sulfuric acid
 added in the ratio 2:1 and used in the test
 the soil was found to contain a large quantity of
 the same kind of soil, the same kind of soil.

This was given on our first visit to the house
on the 1st of June.

The animal is still in the same state;
it is not in the same state.

The 2nd of June

32.73

12.73

The 3rd of June

5.78

5.78

The 4th of June. The mother bird was seen again
at about 10 o'clock.

A second bird from the mother-bird was
seen for the first time. The bird was
seen on the 1st of June, No. I.

In all, it was made to see the bird was seen
on the 1st of June. The bird was seen on the 1st of June.
The bird was seen on the 1st of June. The bird was seen on the 1st of June.
The bird was seen on the 1st of June. The bird was seen on the 1st of June.
The bird was seen on the 1st of June. The bird was seen on the 1st of June.

Acetic acid CH_3COOH
 $\text{N}_2\text{H}_5\text{N}$

Andria salina in the same locality

analysis in the note of 2/11 will be found. From
these analyses only a slight amount of the
white salt was obtained, and it was very
impure. ~~The~~ ^{It} was also found
Fe was not in the analysis in the note
and was the substance of the white salt in
the note.

A solution made in the note of 1/11 was one
of the same substance as the one in the note, containing
5.0 grams of ferric chloride, and 5.2 grams
of o-benzidine hydrochloride in 34 cc. of ~~water~~ ^{distilled} water
and 10 cc. of the concentrated acid. The
solution on heating became first yellow
then quite brown, and then it decomposed. It
was then about the same color and consistency
with about an hour and a half of a
cold solution. The cold solution was then
mixed with a solution of a white salt in
at the same time, and was then the same.

3. + 4. Some of the solution was left over after the
 further solution in the 100% of HCl, using
 2.5 g. of solid sample and 20 g. of HCl
 solution. The solid was mixed up with water
 & ~~diluted~~ ^{diluted}, and 5 cc. of concentrated acid. The
 solution was heated to boiling, for about half
 an hour, when there was a slight oxidation of the
 substance by decomposition. After filtering the hot
 solution and drying it, it was found to be
 given the solution so that the solution could be
 used in the same manner as the original
 5.0 g. of the solid was obtained. In drying
 between filter paper in the glass the color of
 the two samples turned to a brown color.

Analysis of the samples gave the following results:

Sample		Found	
Sample	Calculated	Sample	Calculated
2.5 g. of solid	2.5 g. of solid	2.5 g. of solid	2.5 g. of solid
2.5 g. of solid	2.5 g. of solid	2.5 g. of solid	2.5 g. of solid
2.5 g. of solid	2.5 g. of solid	2.5 g. of solid	2.5 g. of solid

...not so much success in the work; most of the
oxidation-product was formed.

new method of determination It was the next
that the double salt might be obtained from
solution of ferric chloride and oxalic acid by or-
ganic decomposition in ~~the~~^{dilute} hydrochloric acid - the
acid gas, this was tried with such success
that it was found to be the best method.

By this method the hexahydrochloride chlorides
were obtained from solutions of ferric chloride
and oxalic acid in dilute hydrochloric acid.
211, 111, 114, 118 and 112. The acid was the
hydrochloric acid concentrated. Ferric chloride
saturation of the aqueous acid with the salt
... saturating a weak acid with ferric chloride and
salt and passing with the solution in

and the ^{former} solution. It is by the removal
of the salt from the ^{dilute} acid it was de-
monstrated that the substance is an acid.
In solution in water and in other solvents the
salt decomposed into its constituents, which
then united to form the oxidizing product. By
the removal of the salt during a white solid.
The crystals of the salt formed in hot water
and were removed by filtration. The
residue was washed with water and dried in
vacuo. Yield 1.5 g.

Experiment 11. - To a solution of
nitric acid, containing 8 grams of nitric
acid, 1.5 grams of substance, was added 1.5
grams of the substance. The solution was
allowed to stand for 24 hours and then
was filtered. The residue was washed with
water and dried in vacuo. The substances
reacted so that the solution became
green. This was the case with nitric

Solution in H₂SO₄ 21. - 32 cc. of a solution of stannic chloride containing 12 grams of stannic chloride, and 5.27 grams of orthostannic chloride gave a salt as an amorphous mass in such small crystals that their form was not noticed - when the cold solution was saturated with hydrochloric acid &c. It is then filtered off and very slightly dried, in the vacuum, one half an hour, and then dried ^{deliberately} with and removed by the use of phosphoric acid, &c. remaining as a white powder.

Experiments with 20 grams of the same substance

Solution in the salt solution. To 10 cc. of a solution of the same substance containing 6 grams of formic acid ~~3.28 g. of the substance~~ ^{were added} 3.28 g. of the substance. The solution was nearly saturated with the formic acid gas. It became turbid on absorbing the gas. The solution was not in equilibrium in this condition.

The same results were obtained with the same substance.

Experiments with 20 grams of the same substance		Experiments with 20 grams of the same substance	
Substance	Formic acid	Substance	Formic acid
29.39%	29.39%	29.35%	29.74%
29.39%	29.39%	29.31%	29.75%
29.39%	29.39%	29.31%	29.75%
29.39%	29.39%	29.31%	29.75%

Solution in the salt solution. To 10 cc. of a

The ~~whole of the~~ morning was the
in rainy season:

was solid and hygroscopic with one loss of water on standing over water. The substance is insoluble in the alkali salt water, but on treatment with dilute alkali solution it dissolves.

A few analyses of this compound gave the following results:

Found	Calculated	Found	Calculated
$\text{C}_{10}\text{H}_{12}\text{O}_2 \cdot \text{NH}_2\text{Cl}$			
C 57.57%		57.57%	57.57%
H 5.21%		5.21%	5.21%

A sample of the salt given with 1.5% was heated at 25-100°C, when it gave off water. When heated to 125°C it was found that it had become hygroscopic and deliquescent.

The compound is soluble in water, but not in alcohol, ether, or other organic solvents. It is also soluble in dilute alkali solution, but not in concentrated alkali solution.

was not a salt. The water was then
added in a small amount, and the mixture
allowed to saturate. Some crystals of salt
appeared in white, ~~but these~~ could not be obtained,
as they dissolved on shaking the solution
with the ice-water.

The salt of the solution was changed to 2.1
by the addition of 1.55 cc. of a solution of basic
arsenate containing 1 gram of basic arsenate. From
this no salt was obtained.

The salt of this solution was again changed
to 3.1 by the addition of 1.55 cc. of the basic arsenate.
The liquid was cooled in ice-water, and
again saturated with hydrochloric acid & cooled
in ice-water. The solution was then
seen in excess to 20 cc. and must have been
the whole as subsequent work showed.

A second solution in the water ^{1.1} was prepared
from the first, but the amount

...ing. When he died, he said he was down
into the wet solution. He died, I think, of
one of the more common types. In curing the
water in soil water and leaving in the wet gas
nothing separated. Until the liquid was added,
... were rather for an... in the
... ..

The salt was now changed to 2:1 as before,
but from this solution the water had been
... .. in drying, the salt had a
... .. in mass but a
... .. at
... ..
... ..
... ..
... ..
... ..
... ..
... ..

just like the sand in which it was
found. The sand was dissolved in the
acid, and the acid was then the same
as above. By heating the acid was found
with the solution at about 15° when some of the
acid was evaporated. It was then white
in color and saturated with the acid. There
was no oxidation of the anhydrous
acid in this case. The salt was found to
be white. The yellow plates were very
fine and small. The salt was anhydrous.

Analysis of the salt.
A sample of 0.5 gram of anhydrous acid was
found to contain 1.862 grams of anhydrous acid in 100
of acid. On heating in hydrochloric acid
the acid was found to be anhydrous.
The acid was found to be anhydrous.
On heating the acid was found to be anhydrous.

and the salt separated in coming out of solution.
The salt was decomposed.

The water-soluble part of the salt was
mixed with some of the salt separated. This
was a very small amount. It was found
that the water-soluble part of the salt was
decomposed by the action of the water. It was
found that the water-soluble part of the salt
was decomposed.

Soluble in the water of 4.1. - A solution was
prepared containing 5 grams of pure sodium
and 0.08 gram of anhydrous hydrochloric
acid. The solution was of 10 cc. The solution was
made in ice-water, which saturated with the
acid and gas ^{deposited} ~~deposited~~ first the acid. Then it
deposited the salt. It was found
that the salt was decomposed.

The acid gas & the salt gas were the same
as the acid gas.

Calculated for	Found in Salt		
$\text{m. } \text{C}_6\text{H}_5\text{ & } \text{C}_6\text{H}_4\text{H}_2\text{O}$	sol. 111,	sol. 117	sol. 121
Sublime 39.72%	39.75%	39.77%	39.41%
Iron 12.47%	12.51%	12.48%	12.90%

Solution in the dark - The solution was made by adding 100 g. of m-bromine hydro-
 gen chloride to 10 g. of the substance, which
 containing a trace of iron, and the solution
 once began to react at ordinary temperature, a
 dark blackish oil separated. The solution
 was placed in ice-water and saturated with
 hydrochloric acid gas, when the oil solidified.
~~The solid mass~~ This solid looked like the
 dinitrobenzidine substance from the 1st solution.

In removing the solution from the ice-water,
 much of the salt dissolved, so that it could
 not be obtained in condition for analysis.

Diethyltoluidine hydrochloride, or Fe^{+3} Cl^{-} $\text{NH}_2\text{C}_6\text{H}_4$ NH_2 Cl^{-} .

The salt can not be obtained in very satisfactory conditions; only one preparation was obtained in large enough quantities. When solutions in the ratio of 1:3, 1:4 and 1:6 were saturated with hydrochloric acid gas, first the lower salt appeared; but, on continued action of the acid, the lower salt changed to crystalline form and the higher salt was produced.

Solution in the ratio 1:3.—To a solution of 2.643 grams of an-toluidine hydrochloride in 6.2 c.c. of ^{dilute} hydrochloric acid was added 3.88 c.c. of a solution of ferric chloride containing 1 gram of ferric chloride. The flask containing the solution was placed in cold water, and hydrochloric acid gas was passed into it. When the oil appeared, the flask was placed in crushed ice, while the saturation with the acid gas was continued. The solution became colored

the crystals ~~formed~~ in the mass, although
the solution over the yellow plate as in solution 14,
then there were bunches of crystals that looked green.
These were ~~at~~ taken up with the stirring rod
and 2.5 cc. of ~~conc.~~ ^{dilute} hydrochloric acid were added.
On continued absorption of hydrochloric acid, i.e.,
the crystals changed form and the yellow plate
was replaced by finer crystals of a lighter yellow
color. When the change seemed to be complete, the
mass - which looked like the hexamethylenimine
chlorhydrate as it separated from concentrated
solutions - was filtered off.

The salt formed a sticky mass fuming with
hydrochloric acid. It was very difficult to pre-
pare for analysis being deliquescent in the air
and adhering to the weighing-paper. The salt would
not melt - part of it having been dissolved by
the moisture of the air and absorbed by the weigh-
ing-paper - was further dried in a desiccator.

Part of the salt, from the first drying, was dissolved in hot concentrated hydrochloric acid, and the solution was cooled in ice-water. The salt which separated was the dodecylbenzenesulfonate. The analysis of the dried salt gave the following results:

Chlorine 35.61% Sulfur 10.12%.

The ratio of the iron to the chlorine in the salt was 1:5.54. Taking the ratio as 1:6 the salt must have been the dodecylbenzenesulfonate; for which the calculated percentages ^{are} Chlorine 35.83% ^{and} Sulfur 9.85%.

A second solution, in the ratio of 1:3, was prepared which contained the same amount of ferric chloride and of a solution of hydrochloric acid but whose volume was 15 cc. This gave, first, the dodecylbenzenesulfonate, the enhanced action of the hydrochloric acid gas produced the same change as before, and the same result.

which separated seemed to be a mixture of the
two salts.

The ratio of the constituents was changed to
1:6 by the addition of 2.643 grams of the chlor-
idine hydrochloride in 9 cc. of hydrochloric acid.
The solution was warmed to bring all the salt
into solution. When it had been cooled and
hydrochloric acid gas passed into it, the di-
chloridine chloride separated without
formation of the oil. This salt did not change
over to the ligon salt as far as could be seen.
When the beaker was removed from the ice-water
mixture the salt dissolved. The difficulty may
have been the greater dilution of the solution.

A solution in the ratio of 1:6 was prepared
containing 0.5 gram of steric chloride and 3.0
grams of m-chloridine hydrochloride in 10 cc. of
benzene. The di-chloridine salt was precipi-
tated, then some of the lighter line was this

appeared much more in a mass of fine needles. After one to two hours the whole of the crystals seemed to have changed over to this form.

All attempts to get this crop of crystals in another day were fruitless. The mother liquor could not be entirely separated by the use of the filter-pump, and the solution was so strongly acid that the drying-paper was disintegrated and mixed with the salt, so that they could not be separated. No further attempts were made to prepare this salt.

The reaction is as follows: $4\text{HCl} + \text{SnCl}_4 \rightarrow \text{SnCl}_4 + 4\text{HCl}$

~~On mixing~~ The first part of the reaction is a redox reaction and the second part is a complexing reaction - as was the first reaction, more water is produced. In the samples of the salt a balance was made only to find that the composition was not constant; the same was true mixtures. This can be explained by the fact that the reaction is not complete, as was shown by the fact that the reaction is not complete in breaking down the salt into its components.

Solution was made in the ratio of 1:1 p 1:4. From solution in the ratio 1:1 on p-toluidine I received a mixture. From solution in the ratio 1:1 a salt was obtained which is a mixture of the two salts. It is a mixture of the two salts and is not a single compound.

It was found that the reaction is not complete

all, granules. In some cases it was
in the other case as in the
the first case. At 2.11. 0811 gave a
retention of water which was dissolved in
a ^{dilute} solution of 10 and 3.1. The
a low chloride content being 2 gms of basic
chloride in 10 gms. The same solution was
added to the other chloride acid was, even to the
-hydrochloric acid. It is then placed in
a solution and ~~the~~ the acid was last extracted the
by the same ^{quantity} of water.
by that the the solution might be the first the
the other was added and the same was added
passed in the the solution was. It should
not separate, it ~~was~~ ^{was} not added but
with it. The water solution was added
into the water in which the acid was
added. It then was added to the water,
it should not separate.

Section 1. 1811. 1812. 1813. 1814. 1815. 1816. 1817. 1818. 1819. 1820. 1821. 1822. 1823. 1824. 1825. 1826. 1827. 1828. 1829. 1830. 1831. 1832. 1833. 1834. 1835. 1836. 1837. 1838. 1839. 1840. 1841. 1842. 1843. 1844. 1845. 1846. 1847. 1848. 1849. 1850. 1851. 1852. 1853. 1854. 1855. 1856. 1857. 1858. 1859. 1860. 1861. 1862. 1863. 1864. 1865. 1866. 1867. 1868. 1869. 1870. 1871. 1872. 1873. 1874. 1875. 1876. 1877. 1878. 1879. 1880. 1881. 1882. 1883. 1884. 1885. 1886. 1887. 1888. 1889. 1890. 1891. 1892. 1893. 1894. 1895. 1896. 1897. 1898. 1899. 1900. 1901. 1902. 1903. 1904. 1905. 1906. 1907. 1908. 1909. 1910. 1911. 1912. 1913. 1914. 1915. 1916. 1917. 1918. 1919. 1920. 1921. 1922. 1923. 1924. 1925. 1926. 1927. 1928. 1929. 1930. 1931. 1932. 1933. 1934. 1935. 1936. 1937. 1938. 1939. 1940. 1941. 1942. 1943. 1944. 1945. 1946. 1947. 1948. 1949. 1950. 1951. 1952. 1953. 1954. 1955. 1956. 1957. 1958. 1959. 1960. 1961. 1962. 1963. 1964. 1965. 1966. 1967. 1968. 1969. 1970. 1971. 1972. 1973. 1974. 1975. 1976. 1977. 1978. 1979. 1980. 1981. 1982. 1983. 1984. 1985. 1986. 1987. 1988. 1989. 1990. 1991. 1992. 1993. 1994. 1995. 1996. 1997. 1998. 1999. 2000. 2001. 2002. 2003. 2004. 2005. 2006. 2007. 2008. 2009. 2010. 2011. 2012. 2013. 2014. 2015. 2016. 2017. 2018. 2019. 2020. 2021. 2022. 2023. 2024. 2025. 2026. 2027. 2028. 2029. 2030. 2031. 2032. 2033. 2034. 2035. 2036. 2037. 2038. 2039. 2040. 2041. 2042. 2043. 2044. 2045. 2046. 2047. 2048. 2049. 2050. 2051. 2052. 2053. 2054. 2055. 2056. 2057. 2058. 2059. 2060. 2061. 2062. 2063. 2064. 2065. 2066. 2067. 2068. 2069. 2070. 2071. 2072. 2073. 2074. 2075. 2076. 2077. 2078. 2079. 2080. 2081. 2082. 2083. 2084. 2085. 2086. 2087. 2088. 2089. 2090. 2091. 2092. 2093. 2094. 2095. 2096. 2097. 2098. 2099. 2100. 2101. 2102. 2103. 2104. 2105. 2106. 2107. 2108. 2109. 2110. 2111. 2112. 2113. 2114. 2115. 2116. 2117. 2118. 2119. 2120. 2121. 2122. 2123. 2124. 2125. 2126. 2127. 2128. 2129. 2130. 2131. 2132. 2133. 2134. 2135. 2136. 2137. 2138. 2139. 2140. 2141. 2142. 2143. 2144. 2145. 2146. 2147. 2148. 2149. 2150. 2151. 2152. 2153. 2154. 2155. 2156. 2157. 2158. 2159. 2160. 2161. 2162. 2163. 2164. 2165. 2166. 2167. 2168. 2169. 2170. 2171. 2172. 2173. 2174. 2175. 2176. 2177. 2178. 2179. 2180. 2181. 2182. 2183. 2184. 2185. 2186. 2187. 2188. 2189. 2190. 2191. 2192. 2193. 2194. 2195. 2196. 2197. 2198. 2199. 2200. 2201. 2202. 2203. 2204. 2205. 2206. 2207. 2208. 2209. 2210. 2211. 2212. 2213. 2214. 2215. 2216. 2217. 2218. 2219. 2220. 2221. 2222. 2223. 2224. 2225. 2226. 2227. 2228. 2229. 2230. 2231. 2232. 2233. 2234. 2235. 2236. 2237. 2238. 2239. 2240. 2241. 2242. 2243. 2244. 2245. 2246. 2247. 2248. 2249. 2250. 2251. 2252. 2253. 2254. 2255. 2256. 2257. 2258. 2259. 2260. 2261. 2262. 2263. 2264. 2265. 2266. 2267. 2268. 2269. 2270. 2271. 2272. 2273. 2274. 2275. 2276. 2277. 2278. 2279. 2280. 2281. 2282. 2283. 2284. 2285. 2286. 2287. 2288. 2289. 2290. 2291. 2292. 2293. 2294. 2295. 2296. 2297. 2298. 2299. 2300. 2301. 2302. 2303. 2304. 2305. 2306. 2307. 2308. 2309. 2310. 2311. 2312. 2313. 2314. 2315. 2316. 2317. 2318. 2319. 2320. 2321. 2322. 2323. 2324. 2325. 2326. 2327. 2328. 2329. 2330. 2331. 2332. 2333. 2334. 2335. 2336. 2337. 2338. 2339. 2340. 2341. 2342. 2343. 2344. 2345. 2346. 2347. 2348. 2349. 2350. 2351. 2352. 2353. 2354. 2355. 2356. 2357. 2358. 2359. 2360. 2361. 2362. 2363. 2364. 2365. 2366. 2367. 2368. 2369. 2370. 2371. 2372. 2373. 2374. 2375. 2376. 2377. 2378. 2379. 2380. 2381. 2382. 2383. 2384. 2385. 2386. 2387. 2388. 2389. 2390. 2391. 2392. 2393. 2394. 2395. 2396. 2397. 2398. 2399. 2400. 2401. 2402. 2403. 2404. 2405. 2406. 2407. 2408. 2409. 2410. 2411. 2412. 2413. 2414. 2415. 2416. 2417. 2418. 2419. 2420. 2421. 2422. 2423. 2424. 2425. 2426. 2427. 2428. 2429. 2430. 2431. 2432. 2433. 2434. 2435. 2436. 2437. 2438. 2439. 2440. 2441. 2442. 2443. 2444. 2445. 2446. 2447. 2448. 2449. 2450. 2451. 2452. 2453. 2454. 2455. 2456. 2457. 2458. 2459. 2460. 2461. 2462. 2463. 2464. 2465. 2466. 2467. 2468. 2469. 2470. 2471. 2472. 2473. 2474. 2475. 2476. 2477. 2478. 2479. 2480. 2481. 2482. 2483. 2484. 2485. 2486. 2487. 2488. 2489. 2490. 2491. 2

The salt was analyzed. The salt is the same as the one found in the water of the same place. The water is the same as the one found in the water of the same place.

salt was . . . The white powder
 . . . but found that it was almost entirely
 . . . nitrous acid. The solution was
 . . . with nitrous acid and it was
 . . . in the water as an acid salt
 . . .

The results of the analyses of these samples
 of the salt were the following:

Sample 1			Sample 2		
Calculated for $\text{C}_6\text{H}_5\text{NO}_2$			Found		
Carbon	55.85%		55.84%		55.13%
Nitrogen	9.75%		9.35%		10.01%

Substance D - 1.2.12

Substance E - 1.2.12

Substance F - 1.2.12

~~Revised version~~ The work on the substance
with aniline hydrochloride was carried on in a
series of experiments. The results of these experiments
are given in the table. The method of work was
described. The first results were not clear and
the work was then continued. The results of the
work are given in the table. From the work it was found
that solutions of ferrous chloride and aniline
hydrochloride in the ratio of 3:1 - 1:2,
in slightly acid solutions gave mixtures of aniline
hydrochloride and ferrous chloride. The results of the
work are given in the table. It should be noted that
with these mixtures a reaction is observed. The
reaction is given in the table. The results of the
work are given in the table.

[illegible]

the editor and his work is done
in a very good manner.

0.213.3 given to the cat no. 0.2812 at U. of C.

0.2635 gram of the salt gave 0.0198 g. of H_2O .

Expt. 10. 10. 10. 10. 10. 10.
This salt was subjected to a series of
experiments of decomposition and
distillation, from 100 to over a sub-
limation point, and the residue was
mixed with the original salt.

In a series of experiments for solution
was made in the salts 41, 31, 21 and
11.

Solution in the salt of 41. This salt
contained 8.22 grams of ferrous chloride and
4.22 grams of aniline hydrochloride in 50 cc.
of water. It was found to be soluble
in water, no salt was formed. When it
was heated in a vacuum, a crop of the salt was
obtained. By the usual method of
distillation the salt was found to be
soluble in water. The residue was
found to be aniline.

Solution in the test tube 311. - This solution
contained 0.54 grams of fumes chloride and 2.22
grams of aniline hydrochloride in 29 cc. of liquid.
The solution was boiled a short time and then
cooled, under the light of a - cast - lantern at
ordinary temperatures. This was found to be
adequate for analysis. The next morning a
second crop of the salt had formed, but it was
not used for analysis.

Solution in the test tube 311. - This solution
was composed of 7.38 grams of fumes chloride
and 2.22 grams of aniline hydrochloride in
29 cc. of liquid. After boiling and cooling, the
solution ^{deposited} ~~deposited~~ about twice as much of the
light yellow needles as did the solution 311. The
crop of the salt was prepared for analysis.
The second crop of the salt in this case was
not used for analysis.

Solution in the test tube 311. - This solution

continued the same light - white - small
 grains of sand in the water. In 1904 the
 the water was dark and the sand was
 and white. The salt was dissolved by the
 addition of ~~some~~ ^{dilute} hydrochloric acid and stirring,
 it was then left overnight, when there was a
 lot of the light white clay like matter left
 - the rest was salt. The salt was
 dried off and the porous salt was placed in
 analysis.

The analysis of these crops given for 1904

Calculated for	Found per cent			
Fe 2.2, Ca 2.2, Mg 2.2, K 2.2	2.07 ± .1	2.00 ± .1	2.04 ± .1	2.01 ± .1
Potash 3.5.75%	3.5.75%	3.5.91%	3.5.71%	3.5.75%
	3.5.84%	3.5.74%	3.5.15%	
... 13.28%	14.12%	13.51%	14.12%	
		13.74%	13.52%	

A sample of the material, which contained, was run off in the usual way and the residue in the process of solution. The solution was only slightly acid, and on boiling and cooling only a small amount of the material was precipitated by acetic acid was added; the solution was then heated and allowed to set, when the insoluble portion was separated in large quantity. This was filtered off and peroxide of iron, the amount of which were as follows:

Sample	Found	Calculated
Peroxide of Iron	33.57%	33.89%
Iron	13.28%	13.25%

The amount of the material was found to be 1.12 g. This was left in the solution when the large amount of the material was removed.

the mass. After the white crystals are removed
the residue is washed with water and dried.
The salt is then analyzed. It is found to contain
with the residue in the hydrochloric acid.
The residue is then dried in a desiccator
at 100° C. and then dried and, now
the residue was dissolved in water, a solution
of the residue in water is prepared.
The salt is strongly decomposed on heating
even at 100° C. The salt loses weight when
allowed to stand in the sulphuric acid. This
is the only method of analysis in the
method of analysis, the discovery of the salt
is not a problem.

The residue salt is not the same as
remaining in the residue - this is a salt
found in the residue. The residue is
found and some other salts of the same kind.

Thiobacillus thiooxidans (Linn.) Ch. & W.

This salt was obtained from a pure culture of the organism. It is a white, crystalline substance, soluble in water, and it is not affected by heat. It is a salt of the thiosulfate group, and it is a very important compound in the study of the chemistry of sulfur.

~~Thiobacillus thiooxidans~~ The first specimen in the collection was composed of a mixture of a saturated solution of sodium chloride and a nearly saturated solution of sodium thiosulfate. This solution, when heated, gave a white precipitate, which was a mixture of sodium chloride and sodium thiosulfate. This solution, when heated, gave a white precipitate, which was a mixture of sodium chloride and sodium thiosulfate.

The second specimen, in the collection, was made by mixing 20 cc. of the saturated solution of sodium chloride with a saturated solution of sodium thiosulfate.

The third specimen was made by mixing a saturated solution of sodium chloride with a saturated solution of sodium thiosulfate. From this mixture, a white precipitate was obtained, which was a mixture of sodium chloride and sodium thiosulfate.

and no material by adding the water and
by the time the mixture had become
thick the green color had disappeared and the
mixture was yellow. The amount of
water added was about 100 cc.

The final solution was composed of 12 grams
of brown chloride in saturated solution and
no grams of stibidine. The solution was
poured into a beaker. When the water had
evaporated the residue gave a mixture of
brown and yellow. The mixture was
mixed with stibidine by evaporation and crystal
of a different yellow color.

Solution in the salt of 1/1. - As it was found
that these solutions did not contain enough acid,
a second solution was prepared. This, also, was
poured into a beaker. The residue was
poured off and the residue was dried. A
quantity of 4.5 grams of stibidine was added.

In vac. of concentrated hydrochloric acid and
 spec. of mass. The spec. in mass is low,
 and it is not possible to get a spec. of
 mass, when placed on the scale, being broken
 - and it is not possible to get a spec. of mass,
 or a spec. of mass. 3 grams of the dry sub-
 stance obtained. In analysis the result was

Found: $\text{C}_{10}\text{H}_{10}\text{O}_2$

Calculated for

$\text{C}_{10}\text{H}_{10}\text{O}_2$

Chlorine 26.62%

26.36%

26.68%

Carbon 8.72%

8.76%

8.87%

On the 21st ^{June} ~~received~~ a copy of a circular
from the collector - same sent on. This
I have got and printed for the press. In the
morning I have sent in the paper - has since
been printed & has come out as a

Silene spaldingii Greene

that is, the Fe^{2+} is the Fe^{3+} in the Fe^{2+} state.

The second solution in the cell is Fe^{3+} and the Fe^{2+} is the Fe^{3+} in the Fe^{2+} state.

The analysis of these cells gave the following results:—

	Cell I	Cell II	Cell III
Chlorine	27.91%	28.58%	28.15%
	27.92%	28.77%	28.14%
		28.78%	28.15%
Iron	5.37%	5.78%	5.34%
		5.42%	5.39%
Substance	118.23	118.74	118.7

These cells gave positive results on the Fe^{2+} and Fe^{3+} ions.

With the mother-liquor of the Fe^{2+} and Fe^{3+} ions gave the following results:

ing with solution in water ~~and~~, then
dried. The residue was then dried,
but no more was detected.

Solution in the salt of 3.15. It contains
small white crystals. The residue is
of a white and 4.5 grams of o-toluidine
crystals in about 60cc. of water, mostly covered
with white acid. The crystals are
crystals which have the light yellow color
seen from the side and the white tint from
from the end. 3.4 grams of the salt were obtain-
ed. The salt was analyzed.

In further cooling, crystals of a white color
of a white salt, separable. The crystals are
very small, a quantity of o-toluidine was
added, and the solution was dried. The
residue was dried in a vacuum oven and
the salt was dried in a vacuum oven and
the residue was dried in a vacuum oven.

The above salt is a mixture of
 combining ^{from} the above with the solution
 of sodium chloride. The salt given by
 the mixture is -

Found for the salt in a solution

	112	311	?
Chlorine	28.28% 28.34%	26.73% 26.82%	28.28% 28.13%
Sulfur	4.77(71)% 5.00%	5.74% 5.82%	5.72% 5.16%
Water	uncombined	---	slightly combined.
Hydrogenation	1.58	1.60	1.55

The action of nascent hydrogen was tried on
 the salt. It was dissolved in water. The solu-
 tion was dissolved in the acid solution. The
 yellow color changed to a light brown color.
 A precipitate of white or yellowish salt was
 obtained. The salt was in a
 solution of sodium chloride. The salt was in a

-sugar solution, some of which had been
 used. The result was the solution was
 found to be a French brand. The water was
 used. The solution was kept at the boiling
 point for about 60 of the hours; after
 standing overnight, a can of the mixture was
 sent to the chemist. The chemist found
 it was a can of French brand, which was in
 the crystals. 2 grains of the same salt was
 obtained here. It gives the same results.
 an analysis of the following results are given:

28.45%	5.55%
28.45%	5.55%

Preparation of the salt in an aqueous solution
 The salt was prepared in the following manner:
 The 1st portion of the salt was in the solution

The salt was dissolved in the following
in an atmosphere of the same. For this purpose,
a wide-mouth jar was filled with a sub-
-limator, having three holes. Between one of the
rings for ^{the tubes of} the condenser which was to be
in the upper end with a B. sea-valve; the
the other holes passed the small test tubes.
One of these tubes was closed by means of a
short rubber tube and pinch-cock; the other
was connected with a syringe & gas valve. The
object of the closed tube was to hold off the
concentration of the solution. During the de-
position of the salt and the air was drawn out
of the flask by a current of hydrogen which
was continued until the salt was deposited
in the flask.

Solution in the ratio of 2:1. - i.e. solution in

the ratio of 2 parts of salt to 1 part of water.

[illegible]

The following elements:

Carbon 25.99% S 4.34%
25.85% 4.34%

A second solution in the ratio of 2:1 was made like the first except that the volume was 50 cc. On standing, one noted a more or less uniform mixture with fine grains of carbon in the solution. The solution was then filtered and again giving only a fine grain of carbon in the solution.

A third solution in the ratio of 2:1 was made like the first two solutions containing no more of carbon in the solution. But the volume was only 40 cc. The solution was then filtered and the carbon was found to be in the solution. The solution was then filtered and the carbon was found to be in the solution. The solution was then filtered and the carbon was found to be in the solution.

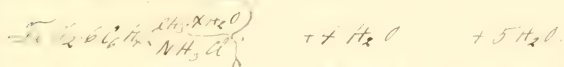
Calculation of results.

Found in sample 1: 1.1401, 1.1401, 1.1401, 1.1401, 1.1401.

	1.1401	1.1401	1.1401	1.1401	1.1401
Calcium	26.738	25.998	26.132	26.888	26.818
	26.888	25.738	-	26.888	26.888

Iron	5.748	4.718	5.738	5.278	4.718
	5.888	4.558	-	5.328	4.838

Calculation of

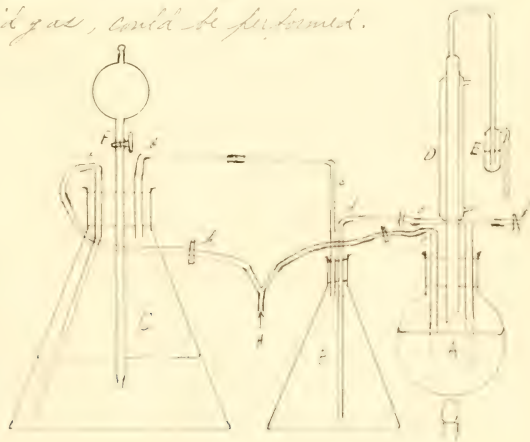


Calcium	26.738	26.888
Iron	5.278	5.278

~~Result~~ of analysis of the sample was nearly finished. This work was then carried on to see if the results first obtained were correct. In view of the results which had been obtained by saturating solution containing the substance.

It is decided to see if it was determined by that material in this case.

This work was carried out in a series of connected apparatus. The apparatus was arranged so that a solution in the boiling flask could be held in an atmosphere of hydrogen whilst any one or all of such operations as, boiling with a solution and/or, evaporating the solution, boiling off hydrochloric acid gas, saturating the solution with hydrogen chloride acid gas, could be performed.



A is a round flask used to hold the solution of the double salt; B is an empty flask used as a trap to catch the solution in A, in case of back pressure; C is a hydrochloric acid gas generator, the gas being produced by the action of concentrated sulphuric acid on concentrated hydrochloric acid; D is the return-condenser, and E is a mercury trap used to prevent access of the air. The V tube at H connects with a hydrogen generator, so that, by means of the connections shown, all the air could be driven out of the work system, and a current of hydrogen under slight pressure could be passed through the system.

Solution in the ratio of 1:1. - A solution was prepared in the flask A by adding to 25 cc. of ^{dilute} ~~hydrochloric~~ hydrochloric acid 4.5 grams or ^{by weighing} ~~by volume~~ of ^{metastigil} ferrous chloride. The ferrous chloride was of an

ment into solution, while the liquid portion
remained suspended in the liquid.

¹⁰⁰ The air was ~~all~~ driven out of the apparatus, pre-
ceding the addition of the ferrous chloride,
and the action of the air thus removed.

When hydrochloric acid gas was passed into the
solution, it became opaque and all the salts
were dissolved. As the solution became nearly
saturated with the gas, a solid substance de-
posited, settling the liquid. This seemed to be
a ~~white~~ ^{white} precipitate of ~~iron~~ ^{iron} chloride,
became oxidized. The mother-liquor was too
thick to distill, thick, white needles, which, when
dried, gave reactions for ferrous iron and for
arsenic.

A solution in the ratio of 1:4 ^{grams} ~~per~~
only to examine hydrochloride when it was
found to be alive.

A second solution, in the ratio of 1:1, was

with 4.5 grams of 1.5% aqueous solution of
picric acid and 19.0 gms of o-toluidine hydro-
chloride in 25 cc. of 1.2% HCl (sp. gr.
about 1.12). This was stirred rapidly with the
magnetic bar, and then cooled in ice-
water, but no crystals formed. The solu-
tion concentrated to about 10 cc., when crystals
began to form. The crystals were filtered
and dried, and gave a small amount of very fine needles. These gave a re-
action like that of o-toluidine, but no o-toluidine
was obtained.

A second solution, just like the above, was
prepared with 4.5 grams of picric acid, 19.0 gms
of o-toluidine hydrochloride in 25 cc. of 1.2% HCl.

Reaction in the acid of 1.2. - 4.5 grams of
o-toluidine hydrochloride were dissolved in 25 cc. of
^{dilute} hydrochloric acid, which formed a saturated
solution when cooled. With the air circulation
of the apparatus in a current of hydrogen, some

3.65 grams of crystallized ferrous chloride was added to the solution. The solution was warmed to dissolve the salt and hydrochloric acid was added to it. A crop of crystals separated that in all like bluish hydrochloride. The solution was again heated and saturated with hydrochloric acid as it would in ice water, but only a small amount of bluish hydrochloride separated in

2. The solution was

over night, and in the morning it was quite filled with fine crystals of the bluish salt which showed the two colors as before described. The surface layer was taken off and dried, then heated for ferric iron, but all the tests showed only ferrous iron.

The mass of the salt was filtered out and prepared for analysis. The dried salt had a brown color, and was very soluble in water, the ferrous salt. When heated in the air with

at 95°C, water was given off. The results of the analysis are given with those of the next sample.

A solution in the ratio of 1:5 gave only triethyl-
ine hydrochloride.

Solution in the ratio of 1:2. - A solution was
made by dissolving 1.0 gram of triethylamine hydrochloride
in 25 cc. of ^{dilute} hydrochloric acid and then
adding 0.5 gram of pure iron wire. It was
driven out of the apparatus by a current of hydrogen
gas. Hydrochloric acid gas was then passed
into the solution as usual.

After the solution was brought to 50°C, hydro-
chloric acid gas was passed into it. It was
then left over night when it came to the tem-
perature of the room. There was then formed a
crop of fine colorless needles. Some in the water.

The solution was again cooled in ice-water
and the hydrochloric acid gas was passed in
to see if there would be any change. It would

was observed. It was now added the base with
 the same result, and again the same
 change occurred. The resulting mixture
 a large amount of pure white salt was the
 result of the reaction.

When the flask was opened the upper layer
 became slightly yellow, and below the salt could
 be dried. It had the same yellow color as the
 previous sample. The mother-liquor formed with
 hydrochloric acid gas. The salt, when heated
 at 100°, gave off water very quickly and in
 great quantity.

The analyses of these two salts gave the
 following results:

Calculated for	Found	
$\text{C}_6\text{H}_5\text{O}_2\text{Br}_2 \cdot \text{NH}_4\text{Cl}$	wt.	wt.
Carbon 46.75%	46.75%	46.75%
Hydrogen 3.75%	3.75%	3.75%
Oxygen 21.25%	21.25%	21.25%
Bromine 28.25%	28.25%	28.25%
Nitrogen 1.75%	1.75%	1.75%
Chlorine 8.25%	8.25%	8.25%

Expt. on a mixture of formic and succinic acids.— After the composition of the hexamethylenediamine chlorosuccinate was established it was a well known fact, in working with solutions of succinic acid and aniline hydrochloride containing some proportion of formic chloride, a salt might be obtained which would contain a larger proportion of aniline hydrochloride. The work was carried out in accordance with the following method.

From a solution containing 1 molecule of formic chloride to 2 molecules of succinic acid chloride there was obtained a double salt in the form of fine needles. When these needles were washed with water they changed their appearance from fine needles to plates. These plates were then washed to remove the traces of the hydrochloric acid by standing over solid potassium hydroxide in a desiccator filled with hydrogen. A sample of the salt was

about 95% and a rather small amount of the other.

It was found that the mixture was

found.

Chlorine	31.13%	Iron	6.75%
	30.90%		6.75%

Ratio of iron to chlorine 1:7.26.

From a second solution, in the ratio of 1:6, a crop of fine needles separated; but they could not be obtained in a better manner.

It was found, however, that the mixture of the fine needles and of the crystals.

A solution in the ratio of 1:4 gave a good crop of ~~fine~~ crystals of iron in the upper layer and the fine needles in the lower layer. The crystals were separated rather easily, and were of a good quality. The crystals were of a good quality, and the needles were of a good quality. The crystals were of a good quality, and the needles were of a good quality.

The layer composed mostly of the 1:1 salt
resulted in a mixture of the 1:2 and 1:1
salts.

Other attempts were made to get a higher
salt than the 1:1 salt and to obtain
in pure condition. However, the indications
are that a higher salt of vanillic acid
and ferrous chloride may be formed under these
conditions.

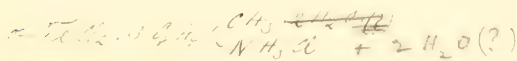
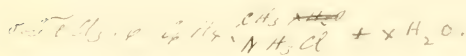
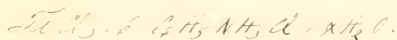
From this study, it was found that the
nitrate of iron does not form the normal ferrous
chlorides with the aromatic substituted compounds
like ferrous feric chlorides and ammonium salts.
The two salts formed are $\text{FeCl}_2 \cdot 2\text{H}_2\text{O}$ and $\text{FeCl}_3 \cdot 4\text{H}_2\text{O}$.
The 1:2 salt is soft and white and is
soluble in water. The 1:1 salt is
not salt of the 1:1 type was obtained. The 1:1
salt was obtained. Some such and some have

the isomeric.

There seems to be a greater similarity between *o*-toluidine and aniline - both giving a 1:6 ratio hexamine and hexamethylenediamine - than between *o*-toluidine and the other toluidines.

With phenyl isocyanide and *o*-toluidine the isocyanide there is produced a double halide of an entirely new type.

The following chemical equations of the law for double halides are,



207 Madison.

The subject of this notice was born in
New York City N.Y. Nov. 12 1867. He was educated
in college at a private school in New York City, and
at Westborough Institute in New York. In 1887 he
entered the University of the City of New York, receiv-
ing the degree of B.S. in 1890. During the years
of 1890-92 he pursued graduate study in chem-
istry and physics at the same place. In 1892
he received the degree of Ph.D. He held the Scien-
tific Fellowship and acted as Demonstrator in
the General Chemistry course 1892-3.

In the Fall of 1892 he came to the Johns
Hopkins University, where he has since con-
tinued his work in chemistry with physics
and mathematics as subordinate subjects.



